Durable Fuel Cell Membrane Electrode Assembly (MEA)

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Applications:

- Membrane electrode assembly process
- Catalyst adhesion
- Membrane production preparation
- Perfluorinated sulfonic acid (Nafion™) and hydrocarbon-based MEAs
- Sensors and/or electrochemical
- devices

Benefits:

- Incorporates disposable, commercially available cuvettes
- Modifiable design
- Allows multiple experiments using a single solution
- Designed for interface with other instruments
- A single cell can be used for multiple experiments

Summary:Conventional polymer electrolyte membrane (PEM) fuel cell technology, suffers from a lack of durability, high manufacturing costs, and rapid performance degradation. These factors overshadow the technology's potential benefits and have prevented fuel cells from entering the mainstream automobile, portable electronics, and power generation markets in which customers are price sensitive and selective in their purchases of durable goods.

A revolutionary method of building a membrane electrode assembly (MEA) for PEM fuel cells has been developed by Los Alamos National Laboratory (LANL) scientists that can significantly increase durability, reduce manufacturing costs, and extend the lifetime of a fuel cell product. This method incorporates a unique polymer dispersion that can be applied to both perfluorinated sulfonic acid (PFSA) and hydrocarbon-based MEAs to produce superior electrode performance, stability, and durability during harsh fuel cell operating conditions.

The LANL-produced MEA has been evaluated and certified using an Accelerated Stress Test (AST) developed by the U.S. Department of Energy (DOE) in conjunction with car manufacturers. The AST was developed to study the durability of state of-the-art MEAs and includes challenging performance targets (e.g., voltage losses of 0.8 A/cm2 less than 30 mV after potential cycling from 0.6 to 1.0 V for 30,000 cycles at 80°C). When comparing the results of the AST from a premier manufacturer's commercially available MEA versus LANL's

novel MEA, the commercially available MEA did not meet the target after 30,000 cycles. However, voltage loss of LANL's MEA still remained below 30 mV even after 70,000 cycles (see figure). Results obtained from two other commercially available PFSA dispersions also fell short of the DOE's target with 48 and 33 mV losses after 30,000 cycles. In addition the LANL MEA fabrication process utilizes a novel swelling agent that significantly lowers hot pressing temperatures and improves the interfacial stability of the MEA.

Development Stage:

Technology Readiness Level: 4 - Component prototypes tested in a controlled environment.

Patent Status:

Method of Preparing Membrane Electrode Assembly, US Patent Application No. 12/321,466 (DOE S-116,251), Patent Application Filing Date: January 20, 2009

Non-Aqueous Liquid Composition of Ion Exchange Polymers, US Patent No. 7,981,319 (DOE S-116,252), Patent Application Filing Date: July 19, 2011

Licensing Status:

Available for exclusive or non-exclusive licensing and collaborative agreements.

For more information, contact Licensing@lanl.gov.

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